KNOWLEDGE

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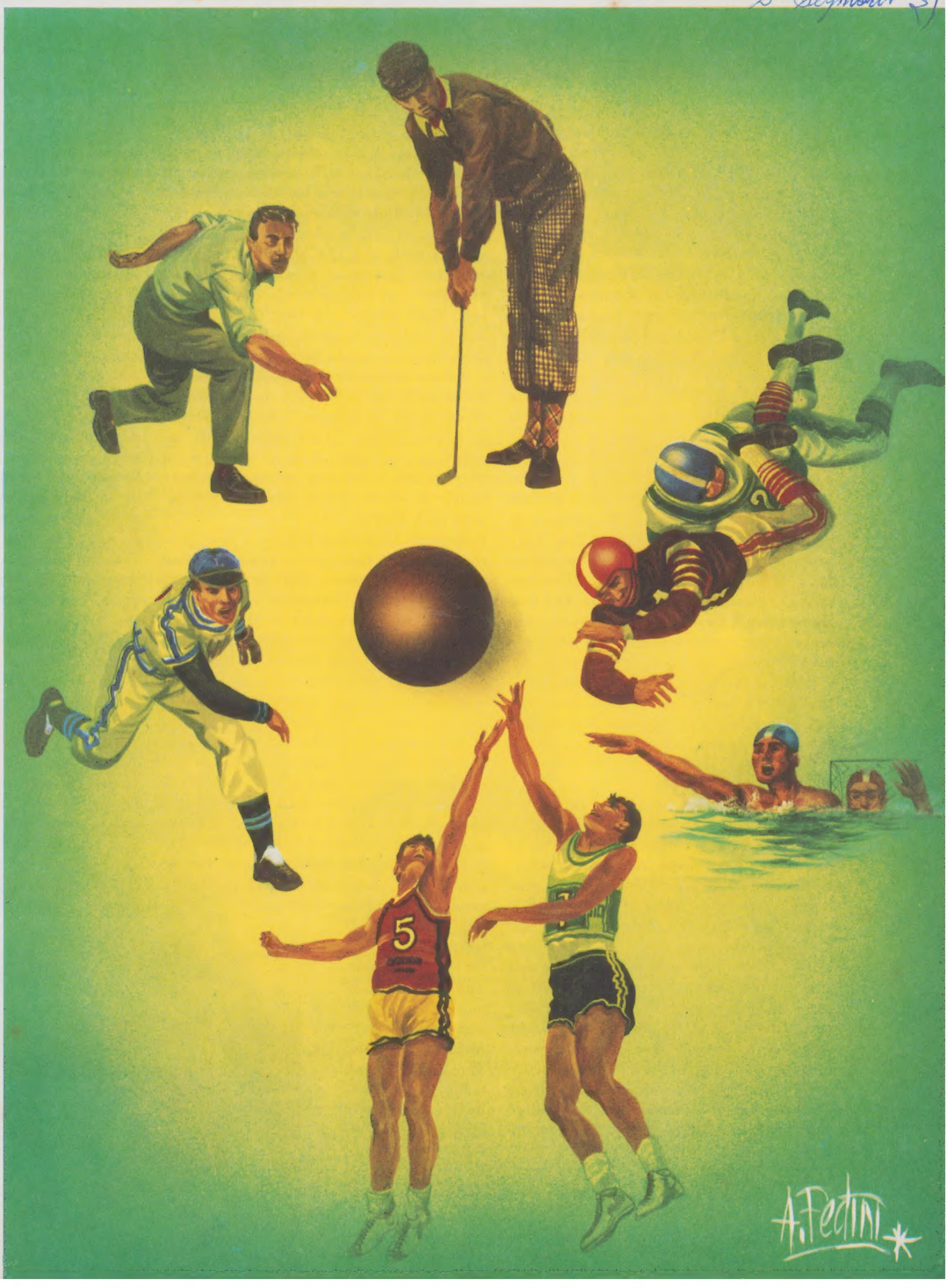

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Editor-in-chief: *John Chancellor, M.A.*

SPORT (part one)

WHEN we mention sport we usually think of the highly active games such as soccer and hockey, or of athletics, tennis, and cricket. In fact the term 'sport' covers a surprisingly wide range of games, from the active ones already mentioned to chess and bridge.

Each of these various kinds of sport, however, has features in common. First of all we take part in a sport for enjoyment. Then there is the satisfaction of gradually developing through practice, and, if possible, expert instruction, the special skills that every sport requires. And finally, each sport provides the thrill and excitement of competition.

Team sports

In all team sports the power of a team depends on the ability of its members to co-operate with each other. You have probably noticed, for example, how powerful a rowing crew appears when the oars strike the water in perfect unison, and how threatening a forward line appears to be in soccer when it advances with the ball passing swiftly and easily from player to player.

Some of the team sports are described in this article. But as most team sports are ball-games, let us first have a brief look at the history of the ball.

History of the ball

A round stone has been used in certain games since the earliest times. Though it was worked smooth, this primitive form of ball must have been rather dangerous! Later it was discovered that bones could be rounded, and then pieces of burnt wood.

The next important development was the invention of a soft ball consisting of a number of reeds tightly bound round each other. Other materials, such as grass, straw, and even leaves, gradually came to be used. In Africa and South America rubber was used, and balls made of skin stuffed with hay have been discovered in Egyptian tombs. But the high-bouncing ball of today, such as the modern tennis ball, is a comparatively recent invention, developed only in this century.

Games in which a ball is thrown

Bowls. One of the oldest English ball-games is bowls, which was so popular in the Middle Ages that it had to be forbidden by law as people were neglecting to practise their archery. It is played on a green of smooth turf, and the object is to roll a large ball, known as a wood, as close as possible to a smaller white ball called a jack. Each player rolls two, three or four woods, and points are scored according to their closeness to the jack.

A form of bowling which has increased enormously in popularity in Britain in recent years is tenpins, which is played in bowling alleys. Hard rubber balls are rolled at ten pins from a distance of 60 feet, and the object of the game is to knock down as many pins as possible with each throw.

Basketball. Basketball is quite a new game compared with most sports. It was invented in the United States in 1891 by a Canadian named Dr James Naismith, as recreation and exercise for students at the Y M C A training school, where he was an instructor. It was introduced to Britain in 1894, and is now a popular international sport.

Basketball is an extremely fast and exciting indoor game played by two teams of five players each. The aim of each team is to throw the ball into the raised basket at their opponents' end of the court. Only one pace may be taken by a player holding the ball, but it can be bounced, thrown, knocked or rolled in any direction, provided it is only with the hands. A goal can be scored from play (two points), or from a penalty throw (one point).

A basketball court is 94 feet long by 50 feet wide. The basket is 18 inches in diameter, and its rim 10 feet from the floor. The ball is round, made like a football, and is 30 inches in circumference.

Netball. Netball is a game rather like basketball which is played by women. It was introduced into Britain in 1895.

There are seven players in each team in netball, and they play on a hard-surfaced court 100 feet long by 50 feet wide. The goal-posts are single posts with a net similar to that used in basketball. The game is played for 20 minutes each way, and goals are scored by throwing the ball, a size five association football, through the opponents' net. The ball is passed from player to player by throwing and bouncing until it reaches the shooter or attack in the shooting area. A player is not allowed to take a complete step or run with the ball, and she may not hold it for more than three seconds.

Lacrosse. Lacrosse is the national game of Canada. Its origin is unknown, but it was popular, in a primitive form called *baggataway*, among the North American Indians by the 17th century. There were no rules in the early Indian game, so that limbs and even lives were endangered during play. During the 18th century, English and French soldiers, and settlers in North America, began to take an interest in the game. The French called the stick used by the Indians 'La Crosse', because they thought it looked like a bishop's crozier (in French *la crosse*).

The first non-Indian club, the Montreal Lacrosse Club, was formed in 1839. In 1867 the first British lacrosse club was set up in Glasgow, following a tour of Britain and France by a team of Caughnawaga Indians. The game has become more popular in England than in other parts of Britain, especially in girls' schools, and the first English Laws of Lacrosse were made as recently as 1st September 1958.

The game is played by two teams of 12 players, for 30 minutes each way. The

Picking up the ball in a lacrosse game. The ball is kept in the crosse by a 'cradling' movement

Previous page: Players taking part in well-known ball games: (from the top) golf, bowls, American football, baseball, water polo, and basketball.

KNOWLEDGE NEWS

Week beginning 23rd June 1963

SECRETS FOR SALE

Today spying has lost a lot of its glamour – it has become very much a matter of hard cash.

IN recent years spy sensations have become almost commonplace: a United States spy plane brought down in Soviet territory; a British businessman convicted of spying by a Soviet court, and an Admiralty clerk convicted of a similar offence in a British court.

However, except in the fictitious worlds of such novelists' heroes as James Bond, whose activities are not complete without high-powered cars, spine-chilling tortures, fabulously beautiful girls, and all the trappings of high life, spying is often a sordid business, and frequently done for money – not for love of country.

Spying can be carried out in the most ordinary surroundings, as was shown in 1961 when a Soviet spy ring was uncovered in a suburban bungalow at Ruislip, near London. Gordon Lonsdale, 37-year-old company director, was sentenced to 25 years; his wife and another accomplice to 20 years each; and Harry Houghton, a 55-year-old civil servant at the Admiralty Underwater Weapons Establishment, was sentenced to 15 years.

The case of Vassall, the Admiralty clerk, was equally unglamorous. He was not a spy because he supported Communism. He was blackmailed by Soviet agents into supplying secret information.

But if there are spies, and there are plenty of them, there must be spy-catchers, and these men (and women) are often more heroic than their quarries.

In Britain, the spy-catchers are in MI5 (Military Intelligence Department 5). Its members are not known to the public, and are mostly paid modest salaries for the tough and exacting work they do.

It is not an old service, for at the beginning of this century it did not even exist. In fact secret services, as such, did not exist anywhere in the world at that time.

It is interesting to note that the first special intelligence bureau set up in this country consisted of *one* man, an ex-Army officer called Captain Vernon Kell. He worked hard and well at his new job, and by 1911 had uncovered a highly organised network of German spies. Proof of his good work came within twelve hours of the declaration of the First World War. In that short time Captain Kell and his few assistants had arrested 21 German agents in Britain.

In 1915 the bureau became MI5, and by the following year German spies were being caught by the hundred up and down the country.

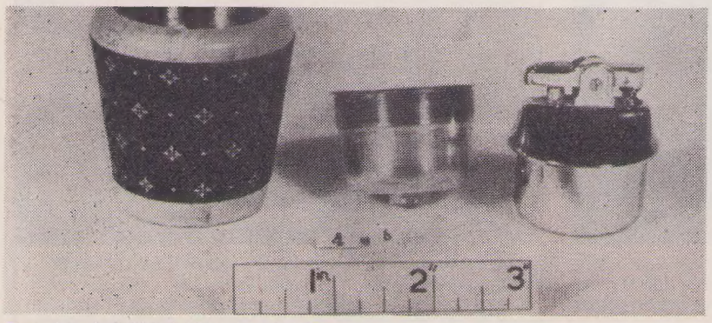
This was the time of the most glamorous spy of all: Mata Hari, the beautiful Dutch girl dancer. She was interrogated in England at one time and accused of spying for the Germans. But she was later allowed to return to the Continent. Then she was caught by the French with incriminating documents in her possession, and after lengthy questioning was sentenced to death.

When she was led before the firing squad she wore her best dress and lavender gloves.

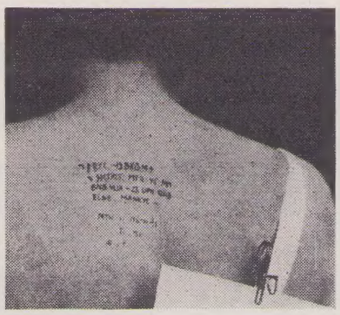
She refused to be blindfolded, and was in the act of blowing a kiss to the soldiers when the rifles cracked and she fell dead; at least that is how the story goes.

Vassall – blackmailed into spying.

Mata Hari – the glamorous spy who is said to have died blowing a kiss.



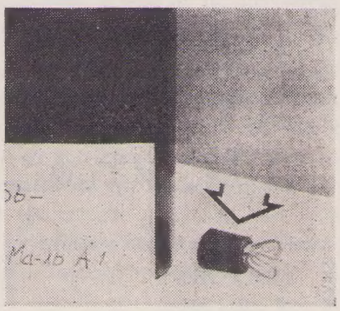
(Top picture) British businessman Greville Wynne (left) on trial in Moscow with Soviet scientific worker Oleg Penkovsky. They were convicted of spying. Wynne was sent to prison; Penkovsky sentenced to death. (Bottom picture) A cigarette lighter with a secret recess used by spies in the Houghton and Lonsdale case.



* * *

Three famous devices used by spies in the First World War. (Above) A message carried by a Belgian woman spy. It was written in invisible ink on her skin. She was discovered by the Germans, and the photo shows one of the messages which had been developed. (Above right) Plans of Austrian forts were discovered by the Austrians squeezed into a bottle cork. (Right) A false eye. The message was hidden in it by a one-eyed spy from Alsace.

* * *



The worst-tempered worker in the world is probably the camel. It groans and moans continuously and is rarely, if ever, affectionate to its owners or riders. In a fit of rage it will lash out and try to bite anyone who happens to be nearby, and the grinding motion of its jaws can inflict a nasty wound. But the camel is almost the sole means of existence for many North African nomads, providing them with meat, milk, and hair from which to make clothes and tents. Loaded with more than a quarter of a ton of baggage, the camel can travel 25 miles a day through arid wastes, or 75 miles carrying only a man, and exist on a handful of dates or beans.

Letter from the Editor

37 HERTFORD ST.
LONDON W.1

THIS week I am writing to readers of Blue *Knowledge*.

You have now reached the end of Volume 2 (issues 13–24) – now for Volume 3 (issues 25–36). Next week you will collect the first number of this volume.

This week's issue contains the title page and table of contents for Volume 3. Put this on the first string of your Volume 3 binder which you can get now – see the announcement on this page for full details.

If you have not yet obtained any binder at all, see the bottom section of this announcement.

Next week's issue will contain the index for Volume 2. If you are collecting the standard binders, you will put this on the last string of your Volume 2 standard binder. If you have decided instead to collect the Easibinders, you will put it on the last rod of your Volumes 1 and 2 Easibinder.

I hope that those of you who have not yet obtained your alphabetical binders will do so soon. These hold the alphabetically arranged cover articles. The first of these binders holds 48 cover articles whose first letters run from A to I. The title page for this binder was in *Knowledge* No. 5. You can get the alphabetical binders in the 3*s*. 6*d*. standard version or in the more luxurious 13*s*. 6*d*. Easibinder version. See your newsagent, or in case of difficulty write to Department B, *Knowledge*, 37 Hertford Street, London W.1. Each order for binders from this department carries the usual 1*s*. 3*d*. charge for postage and packing.

John Chancellor

FACTORS

A word game

The following statements are either 'true' or 'false'. When one is 'true' score the *first* number, but if you think that it is 'false' score the *second* number. Change the numbers into letters (1=A; 2=B; and so on). Put these letters into the squares to make a five-letter word reading down the frame.

The story of Robinson Crusoe was based on the life of Alexander Selkirk (18) – (19).

A monkey's tail can be prehensile (9) – (1).

The most distant point on the horizon is known as the zenith (4) – (7).

Acerbity means kindness (5) – (8).

A velocipede is a name for an early form of bicycle (20) – (19).

ANSWER

(The zenith is the point directly above the observer. Acerbity means bitterness or sourness)

Right

Announcements for readers of BLUE Knowledge

Announcement only for readers collecting the Standard Binders

The Standard Binder for Volume 3 – *AVAILABLE NOW!*

The standard binder for Volume 3 is available from your newsagent *now*. It costs 3*s*. 6*d*.

This binder holds issues 25–36, and is the same as the standard binder for Volume 1, which you got free, and the standard binder for Volume 2 which cost 3*s*. 6*d*.

If you have any difficulty in obtaining it, write to Department B, *Knowledge*, 37 Hertford Street, London W.1. There is a 1*s*. 3*d*. charge for postage and packing on each order from this department, but more than one binder can be ordered for the same charge.

N.B. If you are collecting the Easibinders this does not concern you.

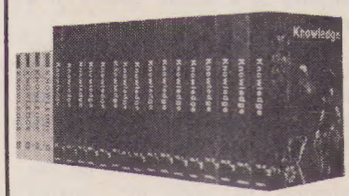
Announcement only for readers collecting the Easibinders

The Easibinder for Volumes 3 & 4 *AVAILABLE NOW!*

The Easibinder is a really luxurious binder. It is extremely hard wearing, has metal rods for binding, and gilt lettering on the specially reinforced spine. It holds 24 issues. In schools, where 'Knowledge' is frequently used as a work of reference, this binder has been found particularly useful.

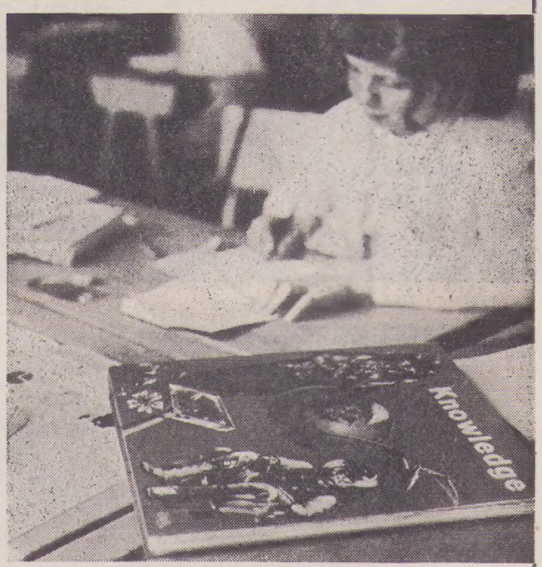
The Easibinder for Volumes 3 and 4 is available from your newsagent *now*. This holds issues Nos. 25–48. It is exactly the same as the Easibinder you got at half-price for Volumes 1 and 2. It costs 13*s*. 6*d*. If you have any difficulty in obtaining it, write to Department B, *Knowledge*, 37 Hertford Street, London W.1. There is a 1*s* 3*d*. charge for postage and packing on each order from this department, but more than one binder can be ordered for the same charge.

N.B. If you are collecting the standard binder this announcement does not concern you.



Knowledge is an encyclopaedia which comes out each week in the form of a magazine. It is thus the only encyclopaedia designed to be read from the first to the last page. If you collect *Knowledge* every week for nearly four years, you will have a magnificent work of reference. Four of the volumes of *Knowledge* contain the cover articles, which are arranged in alphabetical order. These are detached from the remainder of the magazine and bound separately. The other sixteen volumes contain the remainder of the magazine except for *Knowledge News*, which is also detached. Each of these sixteen volumes contains the encyclopaedic sections of 12 issues of *Knowledge*.

COPIES ARE BETTER IN A BINDER



Are you collecting *Knowledge* without putting your copies in a binder? To keep your copies of *Knowledge* in the best condition, and also to ensure that you can refer to them quickly and efficiently, a binder is a 'must'.

You can still get the standard binder for Volume 1, *free*, or, if you prefer, the Easibinder for Volumes 1 and 2 at half-price, merely by sending us the six coupons contained in the first six issues of *Knowledge*. The standard binder for Volume 2 is also still available. It costs 3*s*. 6*d*. See your newsagent or write to Department B, *Knowledge*, 37 Hertford Street, London, W.1.

There is a 1*s*. 3*d*. charge for postage and packing on all orders from Department B, but more than one binder can be ordered for the same charge.

Back numbers can also be obtained from your newsagent or from Department B. They cost 2*s*. each – there is no charge for postage from Department B.

Remember copies are better in a binder.

The imposing façade of the Basilica of St Peter's was the work of the architect Carlo Maderno (1556–1629). *It is* 377 *feet wide and* 148 *feet high. On the central band of the façade is carved the name of Pope Paul V Borghese, who inaugurated it in the year* 1612

ST PETER'S, ROME

ST PETER'S, in Rome, is the largest church in the Christian world. All the most important ceremonies of the Roman Catholic Church take place in this Basilica, including the coronations of the Popes, the canonisation of saints, and the solemn ritual of Holy Years. Some people may prefer the more austere beauty of Chartres or Durham Cathedrals, but the overwhelming size and magnificence of St Peter's are unforgettable.

Early plans for St Peter's

The first Basilica of St Peter's was built by the Emperor Constantine over the place where St Peter had, according to tradition, been buried. This church was consecrated in AD 326, and stood until 1450, when it was decided to build a larger one. The three greatest names connected with the construction of St Peter's are Bramante, Michelangelo, and Bernini. Pope Julius II asked Bramante to design the new church. His design was in the form of a huge Greek cross – that is, equal armed – with a rounded dome (like the dome of the Pantheon) forming the roof. Bramante died after the four massive pillars and arches which were to carry the dome had been built, and Pope Leo X appointed three further architects to work on the project. One of these was the great painter Raphael (see page 1994). He died young, leaving a new plan for St Peter's based on a Latin cross with a long nave. The next architect appointed, Peruzzi, reverted to Bramante's plan. He was succeeded by Antonio di Sangallo who again adopted the Latin cross plan, but he too died before his design could be carried out.

Michelangelo

Pope Paul III then sent for Michelangelo, one of the outstanding figures of Renaissance Italy. 'The Pope,' writes Vasari, 'held the genius of Michelangelo in great respect, and loved and admired him besides,' and he decreed that Michelangelo should be in sole charge of St Peter's. The artist, so arrogant towards other men and so humble in his faith, declared that he would receive no payment but would perform his office 'only for the love of God and in honour of the Apostle'. His plan was a return to Bramante's spacious Greek cross, but the piers, apse, and transepts were strengthened and enlarged to support the dome.

After 17 years, the drum of Michelangelo's dome was completed, but the rest remained unfinished for 24 more

THE DIMENSIONS OF ST PETER'S

Total length:	692 feet	Height to top of the dome:	394 feet
Height of the central nave:	143 feet	Capacity:	80,000 people
Diameter of the cupola:	138 feet	Number of statues:	390
Width of the façade:	377 feet	Number of altars:	45
Height of the façade:	148 feet	Number of domes:	11

The High Altar of the Basilica of St Peter's, surmounted by the bronze canopy by Bernini

Aerial view of the dome, Michelangelo's masterpiece, and of St Peter's Square, showing the colonnades

years. At last, in 1588, Pope Sixtus V gave Giacomo della Porta the task of completing Michelangelo's work. About 800 labourers worked day and night for nearly two years, until the great dome was ready to be covered with lead.

Some 13 years later Pope Paul V commissioned Carlo Maderno, a competent but not an inspired architect, to finish the Basilica. He returned to Raphael's idea of a Latin cross design with a long nave.

Maderno gave the west end of St Peter's a dignified and majestic façade, which unfortunately cuts across the view of the dome. This can best be seen from the Vatican gardens at the back of the Basilica, where the dome springs upwards from a structure as powerful as it is harmonious. Jacob Burckhardt, the historian of the Italian Renaissance, has described its outline as 'perhaps the most beautiful in its simplicity that architecture ever achieved on earth'.

Bernini

The Basilica was dedicated in 1626, after nearly two centuries of designing and building, during which time 20 Popes had sat on St Peter's throne. But the work was not finished yet. When Maderno died in 1629, Gian Lorenzo Bernini was appointed 'Architect of St Peter's'. He had already constructed the splendid canopy, or *Baldacchino*, above the High Altar where only the Pope celebrates Mass. The huge, twisted, bronze columns of the canopy, bearing angels and scrolls which meet under a golden orb and cross, underline the profound change which had taken place in the Basilica since its beginnings.

Once the simple meeting-place of early Christians, the Basilica was now enriched with beautiful marble, gold and other metals, mosaics, and sculptures, with every dramatic effect used to heighten the emotions of those who entered it.

Bernini, a devout Roman Catholic, and a master of theatrical effect, placed his wonderful bronze reliquary containing St Peter's wooden chair so that it was framed by the twisting columns of the Baldacchino, which contrast with

the straight, white marble pilasters of the piers reaching up to the dome. The chair is supported by statues of four Fathers of the Church, and above it, the dove, emblem of the Holy Ghost, hovers in a golden radiance surrounded by clouds and cherubs.

Michelangelo's Pieta *(in St Peter's)*

The imposing aspect of the interior of the Basilica of St Peter's. In the illustration, the central nave is visible in all its majesty, resplendent with gold, and rich with statues and decorations. At the end, Bernini's canopy can be seen, above which is the immense dome. Even the cherubs supporting the holy water stoups are giants 6 feet high

The piazza

Bernini's greatest work is the Square or *Piazza* of St Peter's. This had to be as large as possible to hold the vast crowds which gather at Easter and other occasions to receive the Pope's blessing from the balcony above the central entrance. The Basilica required the grandest possible approach, in keeping with its size and importance, while the people and clergy who took part in the great processions needed protection against sun and rain.

Bernini solved these problems by building a large, oval piazza surrounded by colonnades. He made the façade of St Peter's, which is very long, look higher by joining to it two fairly low corridors which continue the skyline of the colonnades, and are crowned with balustrades on which stand statues of 140 saints. In the middle of the piazza is an obelisk brought from Egypt which once stood in Caligula's circus, and two beautiful fountains. The columns, which stand four deep, look like a stone forest, and give one a sensation of immense mass and power. Bernini himself compared his colonnades to the arms of the Roman Catholic Church, embracing 'Catholics, to reinforce their beliefs, heretics, to reunite them with the Church, and agnostics, to enlighten them with the true faith'.

Treasures of St Peter's

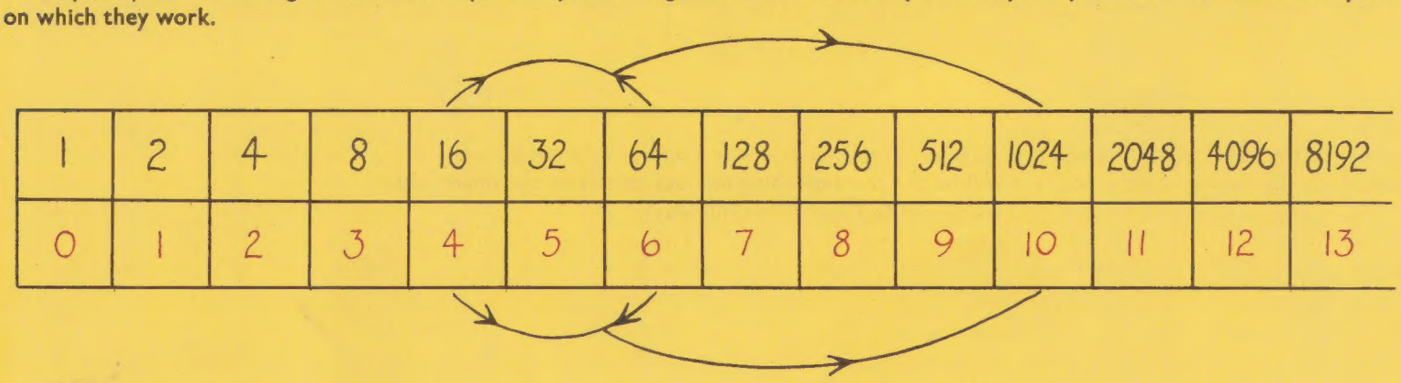
There are many famous sculptures in St Peter's. Among the most beautiful are Michelangelo's *Pieta*, illustrated on the left, and Arnolfo di Cambio's *St Peter*, seen in the illustration on the right. Bernini, one of the chief architects of the church, designed the tomb of Alexander VII and the monument to Urban VIII. Besides these sculptures, St Peter's possesses many lovely mosaics. These decorate the altars and side chapels, and some of them reproduce famous paintings – for instance, Raphael's *Transfiguration.*

The famous bronze statue of St Peter, the work of Arnolfo di Cambio (13th century), in St Peter's

L O G A R I T H M S

DURING the early 17th century commerce, science, and mathematics were expanding rapidly. Merchants, scientists, and mathematicians had to spend a lot of time in making long, tedious calculations they needed for their more creative work. This problem was solved by John Napier, who saw how much of the calculation could be avoided by the use of what are called logarithms.

The principle on which logarithms work is quite simple, although the tables we use may look very complicated. Here is the basic system on which they work.



1	2	4	8	16	32	64	128	256	512	1024	2048	4096	8192
0	1	2	3	4	5	6	7	8	9	10	11	12	13

If you multiply together any two of the black numbers shown above, you will find the answer is also one of the black numbers.

Let us take the sum 16×64 as an example. The answer to this is 1,024. If we look at the red numbers under the black ones we see that they are 4, 6, and 10, and we notice that $4 + 6 = 10$. This suggests that if we want to multiply 128 by 32 we can look up the accompanying red numbers 7 and 5, add them together, which gives us 12, and finally look at the black number above 12, which is 4,096. Check that this is correct by ordinary multiplication, and try some other examples.

So we see that multiplication can be done through addition, which can clearly save us a lot of time. Division can also be done by this method; to divide 256 by 8, subtract the red number under 8 (3) from that under 256 (8). The answer to your subtraction sum is 5; look above it and you will see the black number 32 – the answer to your division sum.

But how does this method of multiplication work? Firstly, what is the connection between any black number and its accompanying red number?

The black number 16 equals $2 \times 2 \times 2 \times 2$, which is written in a short form as 2^4, since four twos are multiplied together. We see then that any red number is the number of twos which must be multiplied together to give the accompanying black number, and 64 equals 2^6 ($2 \times 2 \times 2 \times 2 \times 2 \times 2$), and so on.

Numbers arranged in this way are given technical names.

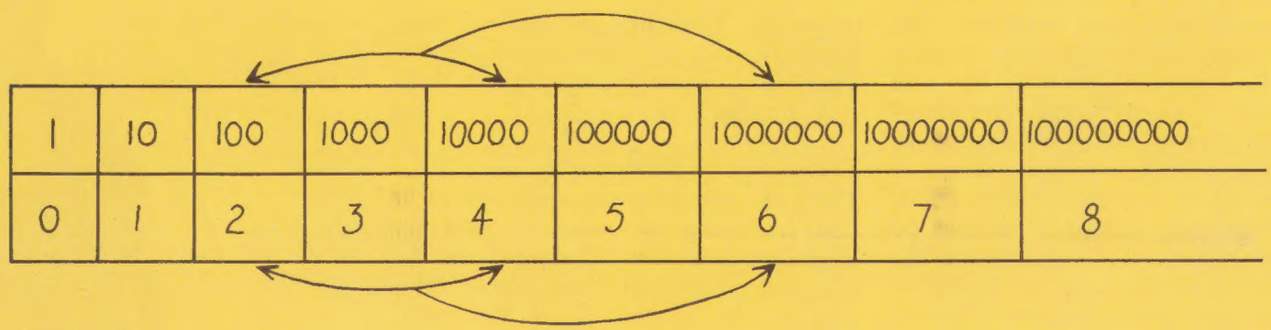
2 is the BASE
6 is the LOGARITHM of 64 with base 2
64 is the ANTILOGARITHM of 6 with base 2

The diagram above shows tables of logarithms and antilogarithms.

Now $16 \times 64 = 2^4 \times 2^6$
$= (2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2 \times 2 \times 2 \times 2)$
$= 2^{10}$ (since ten twos are multiplied together)
$= 1{,}024$

and this explains the addition of logarithms when we want to multiply two numbers together. Try some more examples for yourselves. The division method using logarithms can be explained in the same way.

For normal work 10 is used as a base for logarithms instead of 2, but the principle of operation is exactly the same.

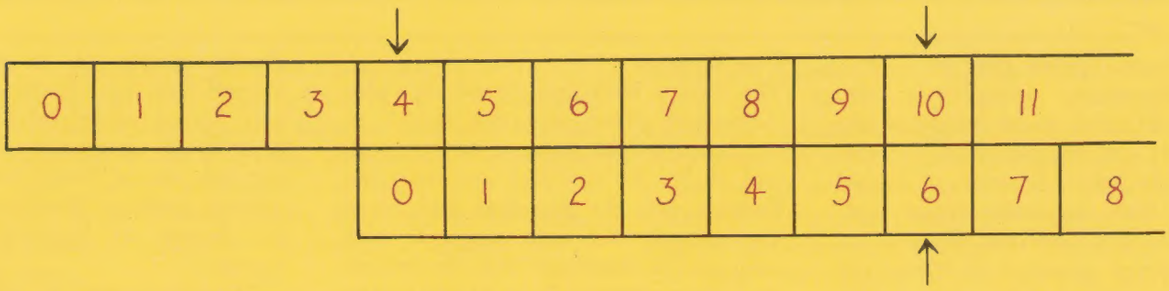


1	10	100	1000	10000	100000	1000000	10000000	100000000
0	1	2	3	4	5	6	7	8

Here you can see that 100 by 10,000 equals 1,000,000. Obviously you will want to use numbers between 10 and 100, and between 100 and 1,000, and so on. These numbers all have their logarithms which have been worked out to many decimal places and can be looked up in LOGARITHM TABLES to save us hours of complicated, lengthy calculations.

SLIDE RULES

If we use two of the red scales addition can be performed mechanically. Here we show the addition of 4 and 6.



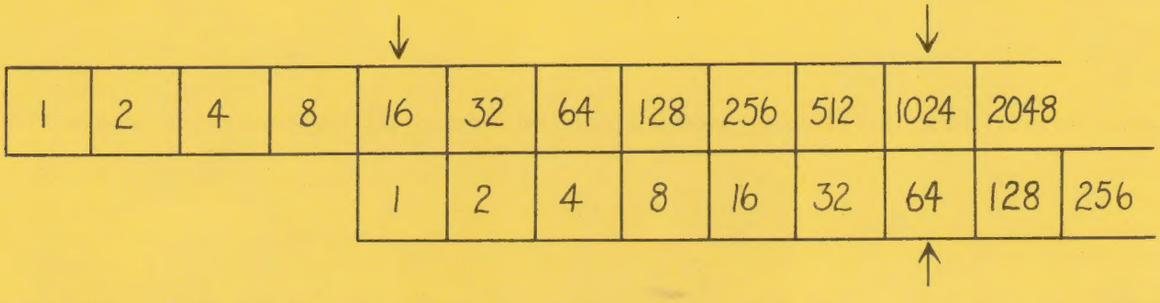
Place 0 on the lower scale (0 is the first number on the scale) under 4 on the upper scale. Look along the lower scale until you reach the number 6; the answer to your addition will be the corresponding number to this on the upper scale.

Two rulers may be used for adding fractions or decimals in just this way.

Subtraction can be done in a similar way; to subtract 4 from 9, place 4 on the lower scale below 9 on the upper, and read the number on the upper scale above 0 on the lower. This is 5 – the answer to your sum.

Since we have a mechanical device for adding, and we have seen that multiplication can be done through addition, it seems likely that there is a mechanical device which will help us to multiply.

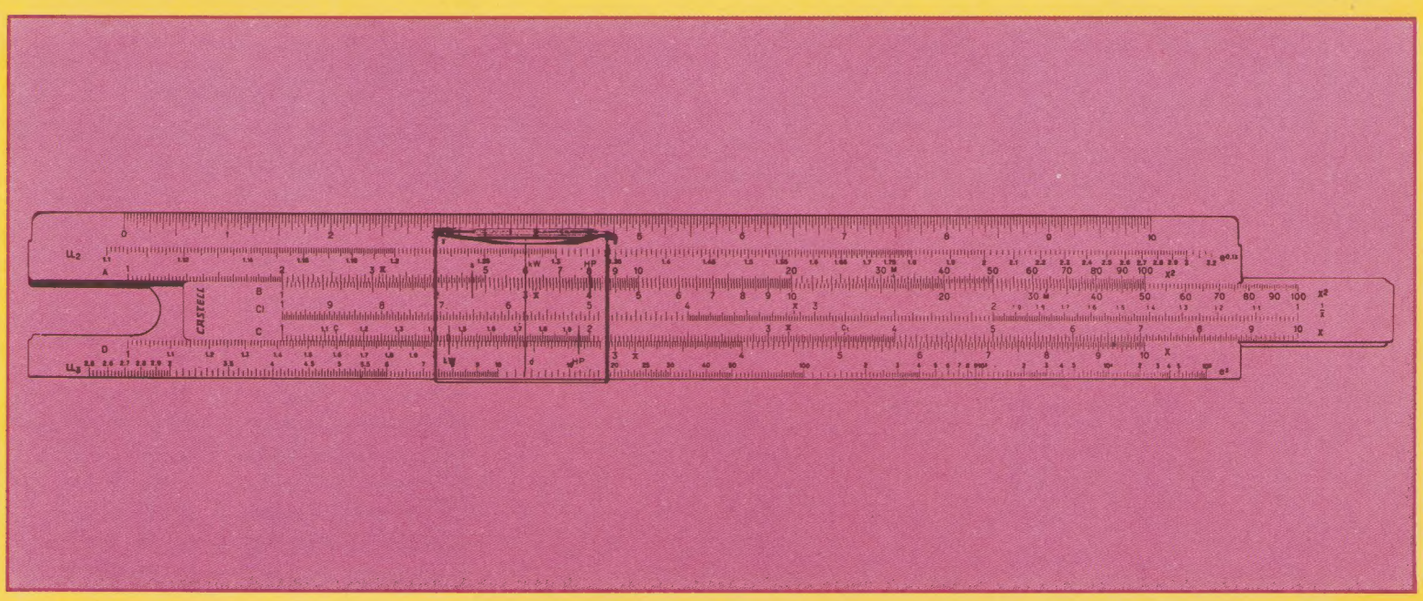
When we look at the original logarithm tables we see that the pattern for addition of the red numbers is exactly the same as that for multiplication of the associated black numbers. So if we use two of the black scales in a similar way to that in which the red scales were used for addition, we shall have a machine which multiplies.



Here we show how to multiply 16 by 64, which comes to 1,024. The 1 in the lower scale (the first number on it) is placed against the 16 on the upper scale, and the answer read off on the upper scale against 64 on the lower scale.

Make two scales out of cardboard and try some other multiplication. Division can also be done with these scales, in the same way as subtraction in the red scales.

These machines for multiplication are called slide rules. Those that engineers and scientists use work on exactly the same basis, and one is shown below.



CHARIOT RACING

'I AM no better known than the race-horse Andraemon,' complained the Roman poet Martial at the height of his fame. He was not exaggerating, for the Roman people were fanatics of horse racing, and both successful riders and their horses enjoyed fame and fortune.

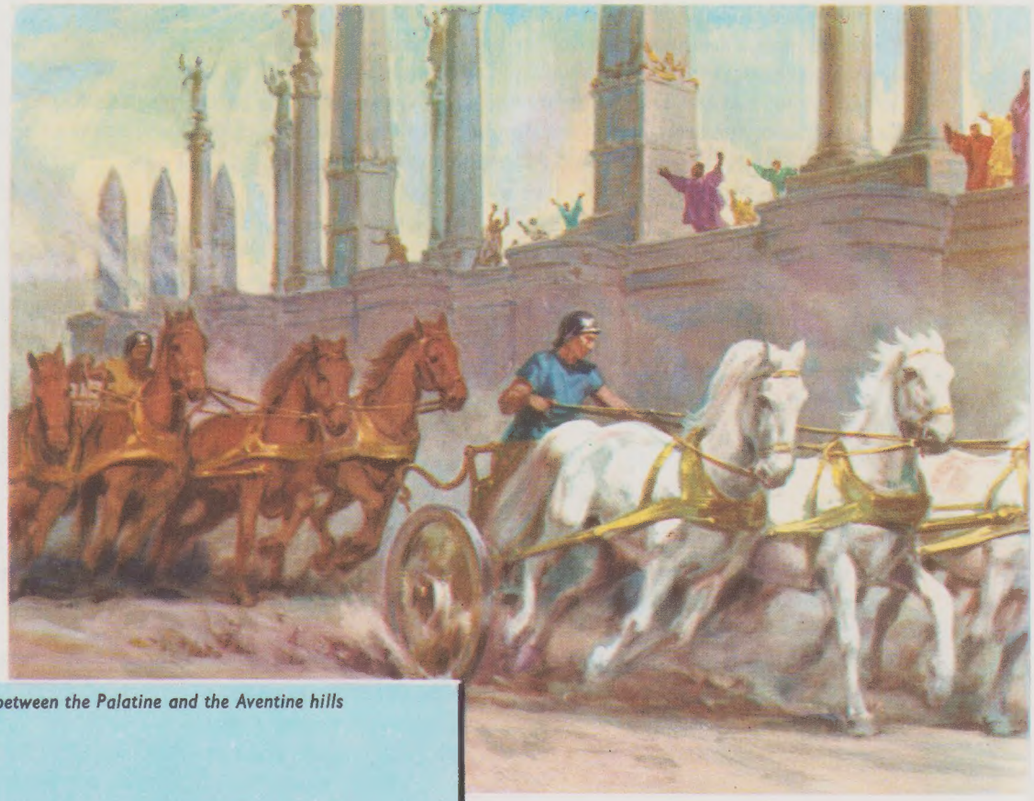
Let us imagine ourselves in Rome on one of the numerous holidays during the Imperial Age. We can be sure that the Emperor, or some wealthy citizen, has arranged for a show of some sort to be put on for our entertainment in one of the many amphitheatres, circuses, or theatres with which Rome is packed. Although the bloodthirsty gladiatorial fights in the amphitheatre are extremely popular, today's entertainment promises to be just as exciting. For the Emperor himself is to preside over the races he is holding in the Circus Maximus (see pages 187 and 651), and we must be there very early if we are to get good seats. Some enthusiasts, in fact, have been in the Circus all night, and the Emperor has sent his guards to keep them quiet.

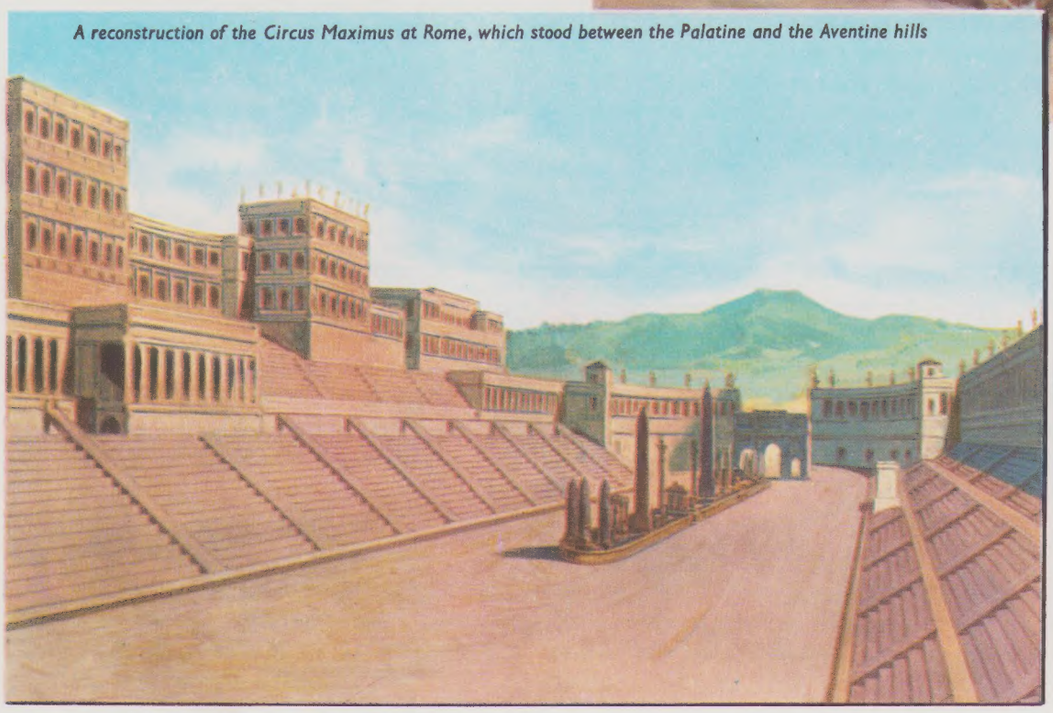
In the Circus the crowd grows steadily, and the uproar increases, as sellers of drinks and sweets peddle their wares. The top tier of wooden seats is reserved for the common people; in front of them are the stone seats kept for members of the Senate, knights, priests, including the Vestal Virgins (see page 186), and other important officials. A special box is reserved for the Emperor and his court.

The Circus

The Circus Maximus, in which these races took place, was not round, as the name might suggest, but oblong, and it lay in a valley between the Palatine and the Aventine hills, in a spot suitable for such sport. It had been used for meetings from the earliest days, but at first the Romans had had to be content with sitting on the bare earth. But the early emperors, especially Augustus, Nero (whose enthusiasm for chariot racing was so great that he himself took part in races), Domitian, and Trajan, all helped to enlarge and beautify it. Eventually it could seat 255,000 people, many more than any modern stadium; Wembley for instance, the largest in England, seats only 55,000.

The races were run round the *spina*, originally a mound of earth in the centre of the course which was later decorated with statues and shrines.





A reconstruction of the Circus Maximus at Rome, which stood between the Palatine and the Aventine hills

The normal length of a race was seven laps, and as each lap was completed a golden dolphin was lowered. The critical moments in the race came during the rounding of the *metae*, the turning posts at each end of the *spina*. It was here that the driver's skill was most tested; he had to go as close as possible to the *meta* without actually touching it and so overturning his chariot. As the driver always had the *meta* to his left, the best horse in the team was placed on the left, and success largely depended upon the co-operation between the driver and the two outside horses, the *funales* (from the Latin *funis*, rope); these were only attached to the chariot by a rope, while the rest of the team were in harness.

IN ANCIENT ROME

CHAMPIONS OF 2,000 YEARS AGO

The chariots were normally drawn by teams of two or four horses, but on some occasions six, eight, or even ten were used. In addition to displaying his skill at driving, the charioteer, or *aurigae agitator*, might perform more purely acrobatic tricks, such as guiding two horses at once, leaping from one to the other, snatching a piece of cloth from the ground, or kneeling on his galloping horse.

The names of the champion jockeys have been preserved for us; Scorpus won 2,048 times, Pontius Epaphroditus 1,467 times, and Diocles, after winning 1,462 times, retired from racing with a fortune of 35 million sesterces, approximately £500,000 in modern currency. The names of many horses, too, have been preserved for us, either from inscriptions made by their proud owners or from sheets of bronze on which disappointed 'punters' (betters) had condemned them to destruction by the gods of the underworld. We hear of Tuscus who won 386 times, and Victor who lived up to his name with 429 victories. Their names have also been found on clay pots and in mosaics on the floors of houses.

A tense moment in the chariot races at Rome; one of the chariots has overturned rounding the meta

The starting signal was given by the emperor or consul who was presiding. He threw a white napkin into the ring as the heralds blew a trumpet blast. The illustration on the left shows the striking costume traditionally worn by the presiding official. Over a scarlet tunic he wore a richly embroidered toga; in his hand he held an ivory staff surmounted by a flying eagle, while on his head he wore a wreath of golden leaves, so heavy that a slave stood by him to help him bear its weight.

The official presiding at the races in his traditional dress

Chariot racing in Rome aroused the same spirit of excitement, enthusiasm, and rivalry that football does today. Each of the four chariots was supported by one of the four 'factions'. These were known as the Greens, the Reds, the Whites, and the Blues. The supporters of the different factions spent immense sums to obtain the services of the best drivers and horses, and paid large bands of supporters to applaud their chariot. Politics entered into the rivalry between the factions, and sometimes feelings in the Circus ran so high that fights broke out which had to be quelled by force. Even the emperors entered into this rivalry between the factions, and sometimes used their authority to ensure the victory of the faction they supported. On one occasion the Emperor Caracalla had the charioteers of the factions opposing his arrested and put to death.

HAITI

THE island of Hispaniola in the West Indies is divided into two separate parts. In the east is the Dominican republic, with a mixed population and Spanish customs, and in the west is the republic of Haiti.

Haiti lies round the Gulf of Gonaives, and is shaped roughly like a horseshoe. Much of the country is mountainous and heavily wooded; torrential streams cut deep into the hillsides. In between the mountain ranges, and along the coast, lie fertile plains. These plains are the centre of the important agricultural development of Haiti.

There is not much variation of temperature in Haiti. The dry season, which lasts from December to February, is slightly cooler than the rainy seasons between April and June, and August and October. Maximum temperatures seldom exceed 90°F.

THE PEOPLE OF HAITI

The population of Haiti is largely descended from African slaves, who were brought over by the French settlers to work on their plantations. Many traditions come from the French, and they speak the French language. They are gay, lively, and happy to live a simple life, and are not particularly concerned with material progress.

The citadel of Christophe near Cap Haitien is a huge mass of masonry perched on top of the highest, and most inaccessible, peak in the district. Christophe was negro king of the new state of Haiti and reigned from 1811 to 1820

EARLY SETTLERS

The first settlers to make use of the western part of Hispaniola were English and French pirates. In 1630 the Ile de la Tortue, in the north, became one of the main strongholds from which pirate bands set out on their raids.

In time the French became the strongest group and established permanent settlements in Haiti, mainly along the northern coast, and the Spanish settlers in the east of the island were eventually forced to accept them. In 1697 Haiti became a French colony known as Saint Domingue. For more than a century the French colonists cleared the bush, developed irrigation (water supply) schemes and, by using imported negro slave labour from Africa, established extensive plantations over most of the plains of Haiti. The main crop of the plantations was sugar cane, but other crops included coffee, cacao, bananas, and cotton. The settlers spread southward, and in 1770 Port-au-Prince became the capital.

THE BEST COFFEE IN THE WORLD

A sugar-cane plantation

Many of the people of Haiti work on the land, and the varied soil allows a wide range of crops to be grown. The French settlers introduced coffee, and ever since Haiti has been famous for the production of coffee of the highest quality. Sugar and sisal are other important crops grown for export today, and there are plans to increase the commercial production

DEVELOPMENT OF AN INDEPENDENT STATE

In 1789 the population of Saint Domingue included about 30,800 white people, 465,400 negro slaves, and 27,500 mulattos (people of mixed European and negro descent). After the French Revolution the slaves became unsettled and revolted against the white landowners. An independent state called *Haiti* was declared in 1804, and in the period which followed, the French plantations and irrigation systems were abandoned. The land was cultivated in small farms by the former slaves, who used primitive methods. The struggles of various political factions for power made the new state unstable, and for a short time (from 1915 to 1934) the United States occupied Haiti, placing it under military rule. The Americans started large commercial plantations once more, but the large population of Haiti remains predominantly African, and continues to cultivate the small farms which are scattered across the country.

The big problem in the country today is the very high density of population (345 per square mile), which is the highest in Central America and is still increasing.

Luxuriant tropical vegetation on the coast

A corner of the market in Port-au-Prince, the capital of Haiti ▶

FACTS AND FIGURES

Surface area:	10,714 square miles
Population:	3,700,000 (1961)
Capital:	Port-au-Prince; estimated population 250,000
Government:	Democratic republic
Languages:	French and Creole
Religions:	Mainly Roman Catholic, also Church of England and some Voodoo
Highest point:	8,793 ft (in Massif de la Selle)
Most important river:	Artibonite
Communications:	Difficult except by sea and air
Monetary unit:	Gourde=about 1*s* 5*d*

◀ *A Haitian girl, carrying farm produce to market on her head*

of rice. The export of bananas, once so important, has nearly ceased, and the production of cotton is also declining. Other crops include cacao, vegetable oils, limes, and coconuts. In recent years some industrial development has taken place, and textiles, soap, flour, and cement are made.

A cargo of coffee for export at Port-au-Prince ▶

THE BOTANICAL GARDEN

THE botanical garden is to the student and lover of plants just what the zoo is to people who are interested in animals. You may go there simply for recreation, to look at interesting and beautiful living things, or you may go, as you do to a museum, to learn about them. We hope that you will try to arrange a visit to a botanical garden when you have read this article, and we suggest that when you go you take with you the article on the classification of plants (pages 599–601).

Soils and climates

We have pointed out the similarity between a botanical garden and a zoo, but of course plants are much easier to keep in 'captivity' than animals are. Feeding problems hardly arise in the case of plants; it is easy to provide special soils, such as peat or chalk, when they are needed. For this reason a more complete and representative series of the plants of the world can be kept in a garden than of animals in a zoo.

The most important thing is to provide the plants with a climate as similar as possible to that of the region in which they live naturally. In Britain this means that only plants of cold and temperate regions can be grown out of doors; tropical and subtropical plants have to be kept in glass-houses in which both temperature and humidity are artificially controlled. It is here that we encounter the one limitation of botanical gardens in temperate climates: very large glass-houses are extremely expensive to build and maintain, and it is quite impossible to accommodate the great trees of the tropical rain forests in them.

Botanical gardens situated in tropical countries can, of course, grow trees from any tropical region. In the very fine botanical gardens at Singapore you can see trees from the Amazonian forests growing side by side with native Malayan species. The tropical orchids there have to be kept in wire-netting enclosures to protect them from the mischievous monkeys which run wild in the gardens; otherwise they would not need to be enclosed at all.

There is a special kind of botanical garden called an *arboretum*. This is a garden where only trees and shrubs grow, and only those that are hardy in the country where the arboretum is situated. At Bedgebury in Kent there is an arboretum mainly of coniferous trees (that is, of pines and firs). Here you can see specimens (still fairly small) of the giant American *Redwoods*, and of the remarkable *Dawn Redwood*, which was known as a fossil before it was discovered growing wild in China in 1945.

Alpine plants in a botanical garden. The thin soil of high mountains has been artificially imitated

In all large botanical gardens of origin. In the

Scientific research

In a large botanical garden you will see a number of ordinary buildings in addition to the glass-houses. These are the offices and laboratories of the scientific staff.

The display of plants is only one of the functions of a botanical garden. Behind the scenes a great deal of important research work goes on, most of which is carried out for strictly practical purposes. Different species of plants are hybridised, by cross-pollination, to produce new varieties for the gardener and the farmer. The glorious and highly priced orchid blooms in the flower shops have mostly been produced in this way. Strains of economically important plants are produced which are able to withstand severe climates and are resistant to disease. Identification of botanical specimens is undertaken by the staff of the plant museum or herbarium.

in temperate regions there are artificially heated glass-houses, in which tropical plants can be grown. Every plant has a label with its name and country foreground on the left are orchids, and the enormous leaves of the Victoria regia *water lily are floating in the warm waters of the pool*

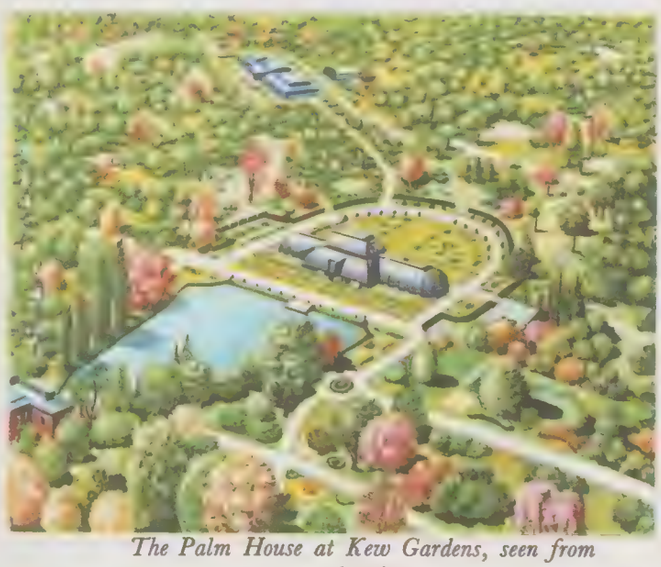
In an arboretum similar work is done with trees as the subject of research. Most of the coniferous trees planted by the Forestry Commission in Britain are of foreign origin. Every kind must first be grown under close observation to see how well it is suited to our climate. The arboretum at Bedgebury is the main centre for work of this kind in Britain.

The Royal Botanical Gardens at Kew

The largest and most important botanical gardens in Britain are those at Kew, on the river Thames six miles west of London. Their early development as a scientific establishment took place under royal patronage during the 18th century. The gardens and greenhouses were opened to the public in 1841, when Sir William Hooker became the first officially appointed Director.

The oldest of the glass-houses is the Palm House, which was completed in 1848. The central part of it is over 60 feet high, and a very fine collection of tropical palms, cycads, and other interesting plants is grown in it. The Temperate House is the largest of the glass-houses. In it are grown plants from the warm temperate regions.

The gardens occupy an area of about 300 acres. Their beauty in spring and summer cannot be described; if you get the chance, go and see them.



The Palm House at Kew Gardens, seen from the air

GREAT DAMS OF THE WORLD

THROUGHOUT the centuries men have tried to control Nature, with varying degrees of success. Their efforts have probably met with the greatest success when they have attempted to harness, rather than to overcome, the forces of Nature. This problem has occupied many men, and no less a man than Leonardo da Vinci, one of the greatest mechanical and engineering geniuses of all time (see page 2007), was fascinated by the possibilities in the use of flowing water.

One of the simplest ways of harnessing water is to build a dam. This is simply a wall (which may be of earth, rock, concrete, steel, or even timber) constructed across a valley or ravine in order to block the natural flow of a river. Dams serve many purposes, some of which are listed below.

How dams can help man

A river that flows steeply down to the sea may be a fierce torrent during the wet part of the year and only a trickle in the dry season. But if a dam is built across its path, the large quantities of rainwater which would otherwise flow away can be stored in a reservoir for use at other times.

Sometimes rivers flow through deep gorges, and the surrounding countryside is dry and arid, while at other times they meander through broad, shallow channels, and the surrounding land is marshy or subject to floods which make it useless for cultivation. A dam can change all this. It can build up the level of water where the land is dry and desert-like, enabling it to be irrigated and therefore suitable for growing crops; and it can stem the flow of water to swampy regions, again with the result of turning them into useful agricultural land.

Yet another important benefit is the electrical power that a dam can be made to produce. When water falls heavily it can operate a water turbine (a sort of paddle-wheel); this in turn can drive a dynamo which produces electricity. (Electric power obtained in this way is called *hydro-electric power* – see pages 1390 and 1391.) Nearly all the major dams throughout the world have generating stations nearby to make use of this controlled flow.

Besides these valuable advantages, a dam, by raising the water level of a river and making it flow more slowly, can render long stretches suitable for navigation.

Dams have been constructed for thousands of years. There are records of a huge earth dam on the river Tigris and a large stone dam on the river Nile, both built in ancient times. There are also records of dams in India and Ceylon as long ago as 500 B C, and the Romans built many large dams in Italy and North Africa.

The earliest dams were built primarily for water storage and for irrigation, but the introduction of electric power, which can be transmitted over long distances by cable, led to the construction of dams in remote, uninhabited areas. As the value of property rose people began to demand that dams be built to protect them from flood damage.

Huge amounts of public money are now being spent on dam construction in the less-developed countries. The new Aswan High Dam, for instance, should make an immense contribution to the United Arab Republic's economy by allowing millions of acres of hitherto arid land to be used for agriculture.

Grand Coulee dam is built across the Columbia river in the state of Washington, U S A. It is part of a project harnessing the Columbia for power, irrigation, and flood control purposes. It is 550 feet high, 4,300 feet long, and is the largest concrete dam in the world.

THE ASWAN HIGH DAM

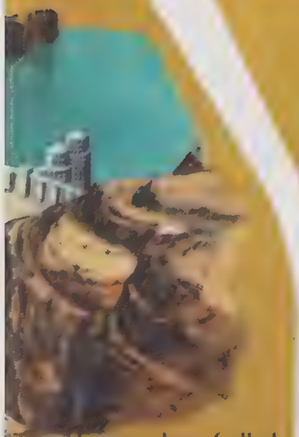
One of the greatest projects of the 20th century is the construction of the new Aswan High Dam in what is known as Upper Egypt. There has been a dam at Aswan since 1902, a long, earth dam which has twice been heightened, once in 1912 and again in 1933. But the need for water for irrigation purposes has made it necessary to build a second, bigger dam. It will probably be completed in 1964. This immense dam (it will be over 11,000 feet long and about 360 feet high) will be extremely expensive to construct.

Considerable assistance has been given to the Egyptians for the new dam's construction, particularly by the U S S R, and it is hoped that the vast benefits which will be derived in the years to come will compensate for the huge cost.

The temple of Phylae near Aswan is already under water for most of the year because of the earlier dam. Unfortunately, a great many other magnificent monuments may disappear for ever when the new dam is completed, including the temples of Abu Simbel, built by Rameses II in the 13th century B C.

Kariba dam is built across the river Zambesi between Northern and Southern Rhodesia. Although Kariba is not itself as big as some other dams, it has caused the formation of one of the largest artificial lakes in the world. Many animals were drowned as the flood-waters built up behind the dam.

Switzerland's Grande Dixence dam has the distinction of being the highest dam in the world. It measures 932 feet from top to bottom (the giant Hoover dam in the United States is only 727 feet high) and contains 520,000 cubic yards of concrete.



The Hoover dam (called Boulder dam until 1947) spans the Colorado river 25 miles south-east of Las Vegas in the United States. Its turbines supply power for Los Angeles and large areas of Arizona and Nevada. Lake Mead, its reservoir, is a huge recreation area.

A great number of the world's largest dams are in the United States. Shasta dam is in northern California and measures 602 feet high and 3,500 feet long. It regulates the river Sacramento for navigation, power, and flood control.

Methods of dam construction

There are four principal types of dams: (1) earth, (2) rock-fill, (3) solid gravity, and (4) arch. The type of dam which is built in a particular place depends on a number of factors, such as the geological nature of the site, its configuration (whether the river flows through a deep ravine or along a wide, shallow bed), the purpose for which it is to be used, and the type of construction materials most readily available in the surrounding area. Dams are also made of steel and timber, but these are usually not permanent structures. Such dams require considerable and costly maintenance and cannot support a very great volume of water.

Earth dams. These are usually built where the site is not suitable for building a heavy concrete dam, and where there are ample supplies of the right type of earth. They have to have a 'core' of clay (or other non-porous soil – concrete is seldom used now), or the water would seep through. This core goes right down into the ground beneath the dam to prevent leakage underneath it. The slopes of the dam must be relatively flat, and are usually protected with grass or gravel on the downstream side and a layer of rock fragments on the upstream side. The largest dam of this type in the world is the Fort Peck dam, across the Missouri river in the United States, which contains 109 million cubic yards of earth and is 10,600 feet long.

Rock-fill dams. These are built in areas far from a supply of cement and where there is no suitable earth available. They are often built across ravines, where rock can be blasted from the flanking walls and allowed to fall straight on to the site. They are similar to earth dams and, like them, need a non-porous core.

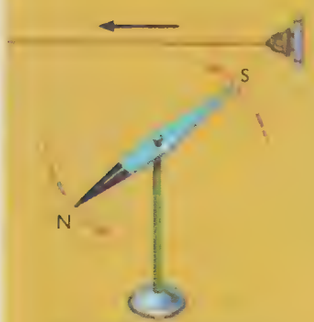
Solid gravity dams. These are the most common of all dams, since they can be built almost anywhere. They are made of concrete (masonry is now rarely used), and, as their name suggests, they resist the pressure of water by their weight alone. The Grand Coulee dam across the Columbia river in the United States is the largest dam of this kind in the world.

Arch dams. Built in narrow gorges which have strong rock walls, arch dams are made of fairly thin concrete. The water pressure is transferred on to the rock walls by the curvature of the dam. The design of this type of dam is extremely complicated and they are not very common.

ELECTROMAGNETISM

THE *lodestone*, a naturally occurring magnetic form of iron ore, has been known for at least 2,500 years. Permanent magnets, obtained by rubbing a piece of steel with a lodestone, were in use as compass needles in Europe about the year 1100, and had probably been known for centuries before this in China. The simple laws of magnetism – that a magnet has two opposite poles, and that like poles repel one another and unlike poles attract one another – were well understood in the 13th century. By the 18th century a few scientists had begun to suspect that there was some connection between magnetism and electricity. At this time only static electricity was known (see page 1054), but the existence of positive and negative kinds of electricity, and the fact that like electric charges repelled one another and unlike charges attracted one another, certainly suggested a similarity with magnetism.

No progress could be made towards confirming this idea until it became possible to produce continuous currents of electricity with the aid of the electric battery, which was discovered by Volta in 1800.



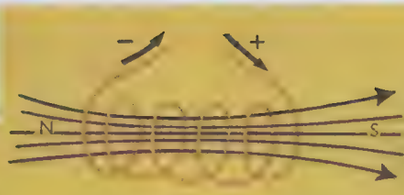
The deflection of a compass needle by an electric current

In 1820 Hans Christian Oersted, a Danish professor who had been experimenting with electricity for many years, found that if an electric current was passed through a wire which ran parallel to a compass needle, the needle was deflected from its north-south direction while the current was flowing through the wire. Since it was known that a compass needle could be similarly deflected by another magnet, Oersted's observation showed that a magnetic field must be produced near a conductor (like the wire) when an electric current flowed through it.

The shape of the magnetic field surrounding a conductor can be shown by passing a wire through a piece of card sprinkled with iron filings, and then connecting the wire to a battery. The filings arrange themselves along the lines of magnetic force as shown in the illustration on the left.

Oersted's discovery aroused immediate interest, and other scientists began work to confirm and extend his experiments.

The lines of magnetic force surrounding a conductor as shown by iron filings

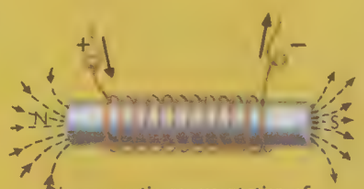


The magnetic field produced by a current flowing in a solenoid

THE SOLENOID

Oersted announced his discovery in July 1820. By September of the same year Dominique Arago and André Marie Ampère had each shown that if the wire which carried the current was wound into a coil, or *solenoid*, all the separate magnetic fields surrounding each turn of wire combined to form a single strong magnetic field through the centre of the solenoid.

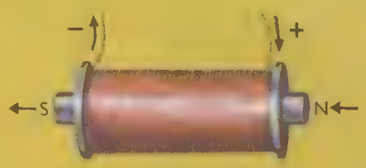
In 1821 Ampère magnetised a steel needle by putting it into a coil through which a current was flowing. A steel needle magnetised in this way remained magnetised when the current was switched off. A permanent magnet had been formed.



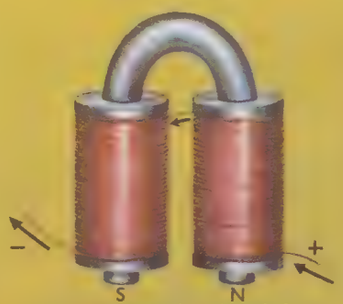
Diagrammatic representation of an electromagnet

THE ELECTROMAGNET

It was soon found that if a piece of soft iron was used in place of the steel, the iron only remained magnetised as long as the current was flowing in the solenoid. When the current was switched off the iron lost its magnetism. In 1825 William Sturgeon built a large horseshoe-shaped electromagnet which would lift 20 times its own weight, and people began to wonder how they could usefully employ magnets which could be turned on and off at will.



Faraday's experiment to show the production of a current in a coil of wire when a magnet is pushed into it



A modern horseshoe-shaped electromagnet

MICHAEL FARADAY

The English scientist Michael Faraday also wondered how electromagnetism could be used. As early as 1821 he had managed to keep a compass needle rotating continuously by passing a current through a suitable arrangement of wires running near it, and had thus shown that it might be possible to make an electric motor.

In 1831 Faraday discovered another very important thing. He found that if he pushed a magnet into a solenoid, an electric current flowed in the wire while the magnet was actually moving. This discovery made possible the building of dynamos.

THE USES OF ELECTROMAGNETS. The first application of electromagnetism was the electric telegraph, developed by Wheatstone in England, and by Morse in America. A telegraph operator, by controlling the current in a wire, could make an electromagnet at the other end of the wire move a pointer which indicated letters of the alphabet on a chart, and so messages could be spelled out.

Today telephones, radios, and electric bells, all depend on electromagnetism for their working. Cranes handling steel scrap often have electromagnets instead of hooks or grabs; when the current is switched on they pick up their loads of scrap, and when the current is switched off, they drop the load.

BARTOLOMEO COLLEONI

ITALY in the 15th century was made up of a large number of independent states, many of them quite small, governed by powerful and ruthless men who ruled as despots. These men were greatly helped by the *condottieri*, professional soldiers who raised bands of mercenary troops and whose services could be bought by the despots (see page 308). The last and least unscrupulous of the great condottieri was Bartolomeo Colleoni.

The Colleoni were an ancient Guelph family from Bergamo, a hill city in northern Italy. At the time of Bartolomeo's birth in 1400, his father Puho (Paulo) was not a rich man. But in 1402, when Giangaleazzo Visconti (see page 1843) died, he left several regents to rule Milan and his other dominions for his three young sons. Inevitably these regents started fighting among themselves for power, and in the chaos that followed Puho Colleoni and his supporters seized the castle of Trezzo and established himself as lord of the region.

Shortly after he was murdered by his cousins, and his widow was thrown into the dungeons of the castle. Bartolomeo narrowly escaped, and took refuge with a schoolmaster who lived in the hills above Bergamo.

The start of his military career

In about 1416 Bartolomeo entered the service of Filippo Arcelli, lord of Piacenza, as a page. When Arcelli was defeated some years later by Filippo Maria Visconti, Bartolomeo fled south to Naples.

The kingdom of Naples was in a state of utter confusion at that time, split by bitter rivalries in the Angevin ruling house. Colleoni first attached himself to Braccio, Count of Montone, who, knowing nothing about Colleoni, placed him among youths who were little better than stable boys, so he left Braccio and joined the Baron Caldora, who gave him command of 35 horsemen. During the time he served under Caldora, Colleoni's qualities as a soldier first became evident; he showed himself to be as brave and calm in battle as he was intelligent. He remained with Caldora until just after the siege of Bologna in 1429.

The vast statue of Bartolomeo Colleoni in the square of Santi Giovanni e Paolo in Venice. The wax model was made by Verrochio (Leonardo da Vinci's teacher) and the casting was done by Leopardi

A complicated career

'His mind was a weathervane; he ran *with* Venice, until he turned and ran *at* Venice.' This was how Doge Dandolo described Colleoni. It seems extraordinary to us that a man should change sides frequently, but we must remember that Colleoni was hired to do certain jobs, and was not bound by loyalties.

In 1430 Colleoni joined the captain general of the Venetian armies, and the next year he passed directly into the service of the Venetians. For the next ten years he fought for them, gaining a high reputation, and serving for a time under Francesco Sforza, perhaps the greatest condottiere of all.

In 1442 Colleoni demanded some pay that was due to him, and when he was refused it he decided to join Filippo Maria Visconti of Milan. But a few years later the Duke suddenly threw him into prison, where he remained until the Duke's death in 1447. The Milanese declared themselves a republic, and gave command of their armies to Francesco Sforza, whom Colleoni joined once more.

In 1448 Colleoni returned to the service of the Venetians. So far his career seems to have been one long series of changes, fighting first for Venice and then against her, first with Sforza and then for the opposing side. But in 1455 he was made captain general of the Venetian armies, and held the post until his death.

In 1453 the Turks took Constantinople, and Pope Nicholas V called for a crusade, but his pleas were ignored by the princes of Italy. In 1468 Pope Paul II again called the princes of Christendom to arms and named Colleoni captain general of a crusade against the infidel. But nothing came of these grandiose plans, and Colleoni remained at his castle of Malpaga until he died in 1475.

His character

Many of the powerful men in 15th-century Italy were cruel and ruthless, although they loved beautiful things and hired great artists and learned men to work for them. Colleoni loved to have intelligent people round him; he liked discussions about philosophy, astrology, and religion, although he was not interested in reading about such things. He was a strict disciplinarian, and it is said that the soldiers of his band were kept together for 14 years by the authority of his name alone.

In his will Colleoni left 100 thousand ducats to the Venetian Republic to help with the war against the Turks, but the Venetians took far more than that and confiscated most of his property that had been left to his wife and children. He also left money to found a *luogo pio* (charitable institution) in Bergamo and gave land to marriageable girls to form dowries for them, and thus encourage marriages. In return for this he asked in his will that the senate of Venice should have a statue made of himself on a bronze horse which would be placed in the square of St Mark. However, no statues were allowed to be erected in this square, but the senate did have the statue made, and it can still be seen in the square of Santi Giovanni e Paolo.

LEO TOLSTOY

Portrait of Leo Tolstoy at the age of 40

LEO TOLSTOY, author of *War and Peace* and *Anna Karenina*, was born in the province of Tula, about 130 miles south of Moscow, in the year 1828. He was of noble birth, being the son of Count Nicholas Tolstoy and Princess Marya Volkonski. His mother's family were descendants of Rurik (the first ruler mentioned in Russian history), and her wedding dowry included the beautiful estate of Yasnaya Polyana on which he was born.

Tolstoy's mother died when Leo was almost two years old. A distant relative, Tatiana Ergolski, helped his father look after the children, and they had a happy life together. But in the summer of 1837 Tolstoy's father died, and the children were put into the care of a legal guardian, the Countess Alexandra Osten-Saken, and spent the next few years either at her home in Moscow or visiting Tatiana at Yasnaya Polyana. The Countess died in 1841, and her sister Pelageya Yushkov became guardian of the Tolstoy children.

Much to Tatiana's grief, she took them away to her home in Kazan, where Tolstoy spent the remaining years of his youth, though he still visited Tatiana every summer. In 1844 he entered Kazan University to study Oriental Languages (Arabic and Turco-Tartar), intending eventually to become a diplomat.

Early manhood

Although as a boy Tolstoy had been a passionate reader, he did not settle down to his work as a student, but he entered fully into the social life of the university. After failing his examinations in his first year, he changed courses, deciding to study Law. This was more successful to begin with, but by 1847 he had decided to leave the university without taking his degree. This followed the news that in the division of the family estates he had inherited Yasnaya Polyana – a large estate with 330 male peasants and their families.

Tolstoy was a man of high ideals, and he felt it his duty to return to Yasnaya Polyana to look after his affairs there, and to improve the conditions of his serfs (as the peasants were called). He made careful notes of his plans to do these things, and of his desire to 'perfect' himself by carrying out his duty, and by reading as much as he could.

Unfortunately, his sincere idealism and youthful sense of responsibility did not prove to be the qualities necessary in dealing with the peasants. After two summers he went to Moscow, and later to St Petersburg (now called Leningrad), determined to obtain a degree.

Once again, however, he began to enjoy a social life rather than apply himself to study, and, in spite of warnings from Tatiana, took to gambling and got deeply into debt. His brother Nicholas, who was serving as an officer with the Russian army in the Caucasus, came home on leave at about this time. When Nicholas returned to duty, Tolstoy decided to go with him, leaving his estate in the care of his sister Marya's husband.

The Caucasus

Tolstoy and his brother arrived in the Caucasus in 1851. He fell in love immediately with the beautiful and dramatic mountain scenery there, and after nine months joined the Russian Cossack regiment, as a cadet, in the fighting against the Tartar hill-tribes. Many of the impressions he formed at this time are to be found in his stirring novel *The Cossacks*, and in short stories such as *Hadji Murad* and *The Raid*.

Although his bravery was often remarked on, Tolstoy was preoccupied with religion, and developed a hatred for the senselessness of war, which is vividly described in his novel *War and Peace*. It was during this period that he completed his first written work, *Childhood*, which was published in a magazine in 1852. He continued as a soldier until 1855, taking part in the Crimean War. But after the fall of Sevastopol in 1855 he went to St Petersburg.

Fame as a writer

Tolstoy's release from the army was obtained in 1856, and by this time he had already achieved considerable fame as a writer. In addition to *The Raid* and *Childhood*, he had already had published *Boyhood*, *Recollections of a Billiard Marker*, *The Wood-Felling*, *The Snow Storm*, *The Two Hussars*, and the various *Tales of Sevastopol*. He soon left St Petersburg to return to his beloved home Yasnaya Polyana which always seemed to soothe and relax him.

In 1857 he visited Switzerland, and in 1860–1861 went to Germany, France, and Britain. He was interested in founding schools, and became specially concerned with the problem of education for those who had not received it as children. He also mixed with farmers, learned their best systems of work, and defended them against unfair treatment from their landlords. After this time he hardly ever left Yasnaya Polyana, and in 1862 he married Countess Sophia Andreyvna Bers, who was a loving and understanding wife.

Tolstoy's masterpieces

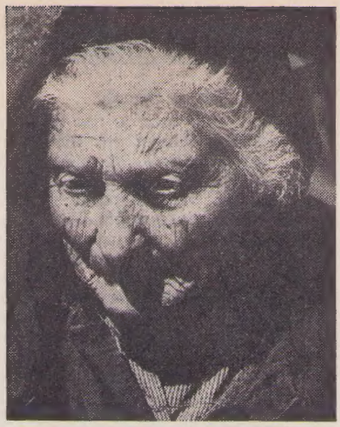
Tolstoy's new family life brought him a sense of peace and security such as he had never known before. In these circumstances, able to dream, think and create at his ease, he wrote two of the greatest works of his century and, indeed, of all time: *War and Peace* (written from 1864 to 1869), and *Anna Karenina* (written from 1873 to 1876). In 1889 he published *The Kreutzer Sonata*, and in 1899 *Resurrection*.

The last 30 years of his long life were full of an increasing anxiety – he was a man who was searching to find the answer to the problems of mankind. He wanted to help the humble and the poor, and he rebelled against violence and war, and against the hypocrisy of the men who surrounded him. His ideals clashed with those of his family, and he finally decided to leave home. He was later joined by his daughter, but flight from his family affected his health, which had been bad for some time, and in a room in the railway station of a small town called Astapo, Tolstoy died, on 7th November 1912. To his wife and sons who had joined him and were weeping around him he said: 'On the earth there are millions of men who suffer; why is everyone here only worrying about Leo Tolstoy?'

'Their eyes are melancholy and liquid.'

BLACK SARAH

Every year without fail a statue in a sun-baked church brings the wandering people of Europe back to a little village by the sea.



'Old heads nodding in time to the haunting, primitive music.'

Black Sarah, like some barbarian queen in all her finery, is borne towards the sea by white-robed gypsies escorted by the 'gardians'.

IN May the roads of Provence are full of some of the strangest pilgrims you may ever see: *romanichels* from France; *zigeuners* from Germany; *gitanos* from Spain; *zingaris* from Italy; *tzigany* from Hungary; and gypsies from the British Isles.

They come in a strange selection of transport: battered, wheezing old cars; gaudily painted horse-drawn wagons; large American cars with trailers. Their hair is dark and their eyes are melancholy and liquid. They are the scattered branches of the mysterious gypsy race.

Every year a statue in a sun-baked church brings them back to the tiny fishing village of Saintes Maries-sur-Mer near Arles in the south of France. The statue stands in the 15th-century church of Les Saintes Maries and is of Black Sarah, the negro servant of the Three Marys, and the patron saint of all these scattered people without a country. This annual pilgrimage is to the gypsies what a journey to Mecca is to Muslims.

Local legend has it that the Three Marys (Mary Jacobea, sister of the mother of Jesus; Mary Salome, mother of St John; and Mary Magdalene) fled from Palestine with their Egyptian servant Sarah. They set out in a boat which had neither sails, oars, nor a rudder. They had no food, but despite this they landed safe and sound where the little village of Saintes Maries-sur-Mer stands today.

But the gypsies do not come to honour the Three Marys. Instead they have come to pay their respects to the black servant from Egypt, for, in legend, the gypsy race originally came from Egypt.

The night before the ceremony the little village is full of gypsies' music. They gather around the camp fires: young gypsies dancing as their ancestors have done in every country in Europe; old heads nodding in time to the haunting, primitive rhythm.

On May 24th the main festival begins, conducted by a bishop who has come specially.

Eight gypsies accompany the ceremony with a guitar. Hundreds of candles are lit, creating clouds of smoke, and making breathing difficult in the overcrowded church, which is decorated in red and yellow, the national colours of Provence.

In the shadowy crypt stands the statue of Black Sarah, her arms, ears, neck and wrists loaded with diamonds, gold and platinum, all offerings from the gypsies. She is like a barbarian queen in her sumptuous and pagan finery. The night before, the gypsies have been visiting her, touching her, lighting candles before her, and making offerings to her.

When the last hymn has been sung, the bells begin pealing and the doors are flung open. The heavy reliquary, which is said to contain the relics of Mary Salome and Mary Jacobea, is taken from its position in the belfry by means of flower-decked ropes. Together with the magnificent jewel-studded statue of Black Sarah, they are borne on the shoulders of sturdy young gypsies in white robes. A way through the dense crowd outside is forced by the local *gardians*, dressed like cowboys and riding on horses. The procession is led by the bishop. Mingling with the procession are the local people. Many of the young girls are in the traditional dress of the Arelate. The pilgrims sing whatever hymn pleases them. The noise is tremendous and sounds more like a riot than a religious procession. They make their way through the narrow streets of the village to the legendary landing place of the Three Marys. The crowds enter the water up to their knees, and the swarthy statue-bearers dip the image of Black Sarah three times in the direction of Egypt – a tribute to their supposed country of origin.

After this the ceremony is at an end, but the singing and dancing continue well into the night.

The next day the gypsies begin to leave. Quietness returns to the little village which must wait another year for their return.

'The young dancing as their ancestors have done in every country in Europe.'

'The night before, the gypsies have been visiting her, touching her, lighting candles before her, and making offerings to her.'

A centipede, in spite of its name, rarely has a hundred legs. Its body is made up of many sections, joined together, each bearing a pair of legs, so the number of legs depends on the number of sections. The house-centipede of North America has only fifteen pairs of legs, which are so long that it looks more like a spider. Young centipedes only have six pairs to start with. There are several thousand different types of centipede in the world, and the largest, which can be more than a foot long, is capable of killing a bird with its fangs.

You write – thousands read!

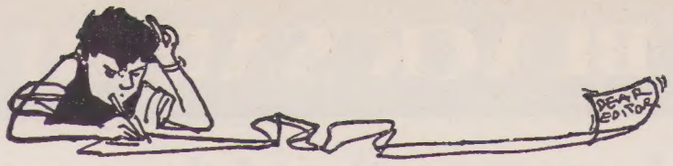
Hilltop Church

DEAR EDITOR—I used to live in Harrow, which is famous for the boys' school. But Harrow is also well-known for the Norman church of St. Mary, built on the highest point in the district. Some of the original building, including part of the tower and a doorway, can still be seen. It is believed that before the Normans built their church there, the site was a Saxon place of worship, and before that, the Druids used to worship in the woods nearby.

Archbishop Lanfranc laid the foundations of St Mary's in 1087, and Anselm consecrated the church in 1094. The windows inside the church tell the story of both the school and the church, and there is a small museum in what used to be a schoolroom attached to the church.

There is a memorial to Lord Shaftesbury there, for it was when he was at Harrow School that he saw the pauper's funeral that inspired him to devote his life to the poor and underprivileged. Another memorial is to the first man killed in a train accident. A plaque outside the church marks the site of an underground spring, where King Charles rested once and gave his horses a drink.

Jennifer Barnett,
95 Herkomer Road,
Bushey, Herts.



Surfeit of Salt

DEAR EDITOR—I have to tell Richard Kasher (Letters Column, 12th May) that 18 packets of salt in a bag of crisps is not the record. I once found 23. Is *this* the record?

Jonathan Hearne (age 11),
Milber C.P. School,
Newton Abbot, Devon.

A leading crisp manufacturer tells me that many more than 23 packets of salt could get into one bag.—Editor.

Amusing Measures

DEAR EDITOR—My mother was looking for a list of weights and measures when she came across the words:

Scottish measures:
2 Mutchkins=1 Choppin
2 Choppins=1 Pint.

We all found this very funny!

Rosemary Evans,
Yew House, Bramshott,
Liphook, Hants.

Weather Man

DEAR EDITOR—My hobby is meteorology, and I take recordings and observations of the weather. If anyone is interested in forming a club on this subject, please write to me.

D. R. Deaton,
Rosebank, Denholm,
Hawick, Scotland.

Stamp Appeal

DEAR EDITOR—I have been collecting stamps for several years, and specialise in Commonwealth ones. But there are several other countries for which I have no stamps, such as Bahrain, Bechuanaland, Grenada, Muscat, New Guinea, St Helena, St Lucia, Somaliland, Tonga, and Zanzibar. Can any *Knowledge* readers help me? I will gladly give stamps from other countries in exchange.

Paul Bainbridge,
18 Birley Street,
Leigh, Lancashire.

Richard of Gloucester

DEAR EDITOR—How encouraging it is to see that you give an unbiased account of Richard III (Wars of the Roses, *Knowledge* No. 117). So many history books take the Tudor records of his reign as the true ones. These were compiled for Henry VII by people who tried to show Richard in a black light and justify Henry VII for snatching the throne.

It is possible that the Princes were murdered, not on Richard's orders, but on Buckingham's. The killing did solve a problem for Richard, but he was not pleased about it.

After his coronation, Richard left London for a provincial tour, and it was probably at this time that Buckingham acted. No doors would be locked to him, for he was Constable and could enter the Tower unchallenged.

Further evidence that it was not Richard who ordered the killing came when Elizabeth Woodville (mother of the Princes) allowed Richard III to remove her daughter from sanctuary and place her in a household, as was the custom in those days. Surely Elizabeth would not have entrusted the safety of her daughter to the man who murdered her sons?

Although we cannot be sure what happened in Richard's reign, it is certain that he was not the 'foul lump of deformity' that Shakespeare made him.

Beryl Foote,
7 The Knapp,
Enmore Green,
Shaftesbury, Dorset.

Name Change

DEAR EDITOR—Your article on Indonesia (*Knowledge* No. 17) mentioned New Guinea. On 1st May this year Dutch New Guinea became West Irian.

Alexander Fisher,
10 Jedburgh Gardens,
Glasgow, N.W.

There is an article about the island of New Guinea, including West Irian, coming in Knowledge No. 135.*—Editor*

Stop Watch

An old Red Indian took his watch to be mended. The jeweller opened the watch up and a dead insect fell out. The Indian, seeing the dead insect lying on the table, said: 'No wonder watch not run – engineer dead.'

Roger Wilson,
27 Great North Road,
Wanganui, New Zealand.

Funny Face

A small boy was sent to the doctor with a note from his mother which read: 'Please will you do something to Johnny's face – he has had it a long time and it is spreading.'

John Underwood (age 12),
R.D.2 Matamata,
North Island, New Zealand.

Daft Definition

An oboe is an American tramp.

Graham Drinkell (age 9),
18 Mansion Hill,
Halton, Buckinghamshire.

Competition Results

The results of the Favourite Animal Competition (set in *Knowledge News* dated 17th March) will be announced shortly.

Can you answer these?

Fill the gap:

1. B, bee; Q, queue; T, ——.
2. Grandfather, grandson; father, son; uncle, ——.
3. Head, hat; neck, collar; hand, ——.

Give the middle term:

4. 20; 40; —; 160; 320.
5. 30; 60; —; 120; 150.
6. 40; 20; —; −20; −40.

Anagrams: Rearrange the letters of these words to make other words; the number of words possible is indicated in brackets.

7. TIME (3); 8. TEACH (1); 9. SAID (2).

Why can you not answer these?

10. Which is greater – a shilling or a penny?
11. Which is heavier – a pound of lead or a pound of silver?
12. Which is higher – a church with a tower by the seaside or a church with a steeple on a hill-top?

ANSWERS

1. Tea (or tee).
2. Nephew.
3. Glove.
4. 80.
5. 90.
6. 0.
7. Mite, emit, item.
8. Cheat.
9. Aids, dais.
10. 'Greater' might refer to size or value.
11. 'A pound of silver' might mean £1 or 1 lb.
12. 'Higher' might mean height above sea-level or height of building; furthermore there is no standard of measurement of towers and steeples.

BRAIN ? BOX

1. A palindrome is a word or sentence which reads the same whichever end you start. A famous one contains 13 letters: 4 A's; 1 C; 2 I's; 2 S's; 2 T's; and 2 W's. Can you work this out?
2. How many four-figure numbers are there? (No decimals – no working out on paper – just do it mentally.)
3. (a) Canadian tree;
   (b) Book of maps;
   (c) Summer fruit;
   (d) Title of Keats' poem (she is a snake woman);
   (e) You write it at school.

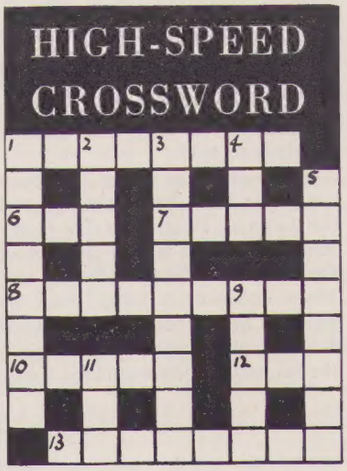
   These are clues to five 5-letter words.

   Draw a 25-square square, 5 by 5. The answers to the above clues can be fitted into this frame, each word being used twice, across and down.

ANSWERS

1. WAS IT A CAT I SAW?
2. 9,000 (1,000 is the first and 9,999 the last).
3. MAPLE
   ATLAS
   PLUMS
   LAMA
   EASY

HIGH-SPEED CROSSWORD



Clues Across

1. This may describe the roof of the old-world cottage (8).
6. Pen point (3).
7. Belonging to Eire (5).
8. Chess player's announcement to his opponent (9).
10. Breakfast bread (5).
12. Perform (3).
13. Unlucky number? (8).

Clues Down

1. Holding on in persevering fashion (8).
2. Walk at an easy pace (5).
3. Summer sportsman (9).
4. Old Testament priest, master of Samuel (3).
5. Offer harm to one's enemy (8).
9. Not asleep (5).
11. Tree with silver bark (3).

Solution next week.

SOLUTION TO LAST WEEK'S CROSSWORD

ACROSS: 1, Kangaroos; 6, Ogres; 7, Elm; 8, Leek; 9, Abel; 12, Don; 14, Visit; 15, Entertain.

DOWN: 1, Knowledge; 2, Nerve; 3, Also; 4, Ode; 5, Simpleton; 10, Basra; 11, Over; 13, Nut.

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goals, which are 6 feet high and 6 feet wide, are placed 40 yards from the centre line in each half. Each team tries to get the ball, of solid sponge rubber, into their opponents' goal. The crosse (or stick) is made of light hickory wood, and is usually about 5 feet long with a bend at the top. Across the hooked portion is strung a mesh of cord and rawhide, making a pocket with which the ball can be carried, thrown, or caught. A player must not handle the ball, but may propel it with his or her foot.

Games in which the ball is hit

Cricket. The traditional summer ball-game for the majority of English boys and men is cricket. One of the most striking characteristics of this game is the length of time it lasts. Whereas the average playing time for a ball-game is about an hour, school and club cricket generally lasts an entire afternoon and part of the evening. Three days are allotted to county matches, and most Test Matches take five days.

The earliest positive record that we possess of cricket is that it was played at the Free School of Guildford around the middle of the 16th century, and there is written evidence of a match played between two teams of 11 players which took place in Sussex in 1697. The earliest known laws of cricket are dated 1744. In 1787 the Marylebone Cricket Club (known as the M C C) was formed. The year after its formation the M C C completely revised the laws of cricket, and from that time took responsibility as law-makers for the game and controllers of its administration.

The cricket pitch is 22 yards long, with a wicket, consisting of three stumps with bails resting on top, at either end. The pitch is situated in the middle of a large field around which is marked a boundary line. The art of cricket is to defend the wicket, while scoring as many runs as possible. The ball is bowled to one of the two batsmen, who stands in front of his wicket. His aim is to hit the ball as far as he can, so that while the fielders are retrieving it and returning it to the wicket he and the other batsman can run as many times as possible between the two wickets. If he hits the ball along the ground and over the boundary he scores four runs; if it crosses the boundary line before it touches the ground he scores six runs.

The bowler attempts to bowl the ball in such a way as to dislodge the bails from the stumps, or make the batsman give a catch. If he succeeds, or if the ball is caught without a bounce after leaving the batsman's bat, the batsman is declared out. Other ways of getting a batsman out are: stumping, if the wicket-keeper can knock the bails off the stumps with the ball while the batsman is outside his crease (the area immediately in front of the wicket, bounded by a white line); running out, if a fielder knocks the bails off in the same way while the batsman is still making a run; and L B W (leg before wicket), if an accurate ball hits any part of the batsman's body (except his wrist) while in line with the stumps. The rule does not apply to a ball which turns from outside the leg stump.

When all the members of one team have batted, they take their places on the field while the other team attempts to score runs. The team which scores the greatest number of runs is the winner; if the time limit to the game is up before the team batting second has overtaken the other team's score, and it still has batsmen to bat, the match is a draw.

Rounders. This is another popular summer ball-game, particularly with children, as its rules can be adapted to let any number of people play, and it needs no very special equipment. It has been played in England since Tudor times, although rules were first drawn up in 1889.

The rounders field is marked out in the shape of a diamond, with sides of 39½ feet. At one point is the batting square, and at the other three are posts, by each of which stands a fielder. A fourth post is on a line with the batsman. The bowler stands in the centre of the diamond and throws a hard

Special shoes and pads to protect the goalkeeper are worn in a hockey match

Polo needs a combination of a quick eye and good horsemanship

ball underarm at the batsman, who hits it with a stout stick as hard as possible. The aim is for him to run round the diamond before the ball is returned to the bowler, and thus score a 'rounder'. He can stop at any post if he feels it would not be safe to run farther. He is out if the fielding side hits the post to which he is running with the ball before he gets there, and if the ball is caught before it bounces. All the players in a team (usually nine) bat one after the other.

Polo. Polo has a very long history, for there are accounts of its being played in Persia in the 6th century B C. The name polo is derived from a Tibetan word *pulu*, used to describe the ball. It survived into the 19th century in India, where it was learned by English soldiers and planters. It became so popular among Englishmen in India that in 1869 it was introduced into England by the 10th Hussars regiment. The Hurlingham Polo Association was formed in 1874, and is now the governing body of British polo and controls the rules. Since the Second World War the game has become popular in the United States and in Argentina.

Polo is a stick and ball game, played on horseback by two teams of four players: two forwards, one half-back, and one back. In Britain it is usually played on a ground 300 yards long by 160 yards wide. The goal-posts are 10 feet high and 8 yards apart, and the ball is made of bamboo or willow root. The stick is usually about 4½ feet long, with a cross-head 9 inches long which is used to strike the ball. A polo match can consist of four, six, seven or (rarely) eight

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Sport (part one) *Cover*
St Peter's, Rome *2049*
Logarithms *2052*
Chariot racing in Ancient Rome *2054*
Haiti *2056*

contents

The botanical garden *2058*
Great dams of the world *2060*
Electromagnetism *2062*
Bartolomeo Colleoni *2063*
Leo Tolstoy *2064*

contents

chukkas (periods of 7½ minutes). After each goal scored the teams change ends, and each player uses from three to six ponies during a match.

Some of the 'toughest' team games

Association Football. Association Football, also called soccer, is a popular winter game for boys and men in all parts of Britain. Forms of football have been popular for many centuries, and there are records of Ancient Greek and Roman forms of the sport. The game has long existed in Britain in the form of mass scrimmages, but did not develop as a game of skill until the 19th century. Steps were then gradually taken to organise the rules, and teams of 11 men came into fashion in the 1860's. Finally, in 1863, the Football Association was formed. This is the body responsible for organising the standardised rules of the modern game.

A rugby tackle; help is coming to the player with the ball from his team's 'pack'

The basic structure of each team in a game of soccer is a series of formations of five forwards, three half-backs, two full-backs, and a goalkeeper. The two teams face each other on a rectangular pitch with goal-posts at each end, 8 yards wide and 8 feet high. Their object is to get the ball between the posts of their opponents' goal in order to score a goal. To do this the players may dribble the ball with their feet, but may not handle it.

In soccer, the team sense is highly developed, and usually operates on a basic structure of attack by forwards, with support from half-backs, who also remain ready to drop back in order to help the full-backs and the goalkeeper in defence of their own goal.

Rugby Union. Rugby Union is believed to have had its origin through an accidental event which took place in 1823. During a ball-game at Rugby School, a boy named William Webb Ellis is said to have picked up the ball and run forward with it in his arms, which was against the rules of the game being played. The new game which grew out of this incident took its name from this famous school.

The game is often called rugger, and is played by two teams of 15 players. The ball, which may be carried, has an unusual shape, being oval instead of round. In rugger the goal-posts extend high above the cross-bar, for goals are scored over the bar and not below.

The object of the game is for a player to touch down with the ball on the ground behind the other team's *try line* (within which the goal-posts are set), and so score three points for a *try*. The ball is then brought back onto the field of play and set on the ground in line with the touchdown. One of the team which has scored the try attempts to kick the ball over the cross-bar between the posts. If he succeeds the try is said to have been *converted* and an extra two points are scored. There are three other methods of scoring, each worth three points: the dropped goal, when the player drops the ball to the ground and kicks it on the half-volley over the cross-bar; the penalty goal, which may be taken either as a place kick or as a drop goal, the two kicks just described; and, finally, the rare goal from a mark, when a player successfully makes a 'fair catch' not too far from the opponents' goal, and at the same time marks the ground with his foot and cries 'mark'. He is then allowed to take a place kick or a drop kick.

Hockey. Forms of hockey have been played since very early times. A similar stick game was played by the Ancient Persians, Greeks, and Romans, and there is evidence in South America that the Aztec Indians also enjoyed such a game. But the game as we know it today did not begin until about 1875, and the Hockey Association was founded in 1886. In Britain the game is very popular both with men and women, though there are one or two minor differences in the rules they use. Other British games of similar origin to hockey are hurling, shinty, which is played in Scotland, and bandy, played in Wales.

There are 11 players in each team in hockey, and their positions on the field are described by the same terms as in soccer.

The hockey stick is curved at the end and flat on one side, and only the flat inner surface may be used in play for striking the ball. Players are not allowed to handle or kick the ball, but if it is travelling high above the ground may stop it in the air with their hand, provided they do not hold on to it. Goals are scored by hitting the ball between the goal-posts, which are 4 yards apart and have a net behind. A goal may only be scored within a certain area, however, which is marked by a semi-circle of 16 yards radius around each goal-mouth.

Hurling. Hurling is an ancient game often referred to in early Gaelic literature, and is widely played in Ireland.

The game is played on a pitch 160 yards long by 90 yards wide, and there are 15 players in each team. The hurling ball is covered with white chrome leather. The stick used, called a hurley (or *caman* in Irish), is made of ash, and is 3 feet long with a bend for the striking part (or boss) which is about 2½ inches wide. One of the distinguishing characteristics of this game is that the ball is hit with the hurley overhead as well as on the ground. The skill with which the flying ball is controlled is very surprising to people seeing the game for the first time.

Two players racing for the ball in a soccer match